ESTIMATION OF SHORT ODOR EVENTS BY USING CHEMICALLY REACTIVE ODORANTS ATMOSPHERIC DISPERSION MODELLING AROUND A PULP PAPER MILL

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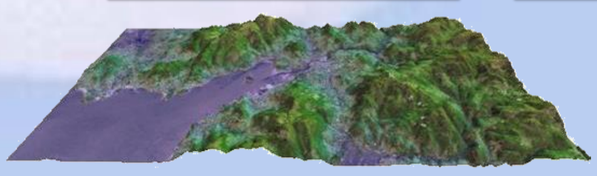
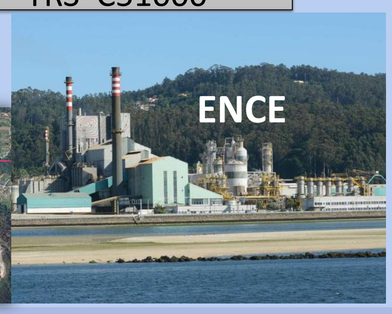
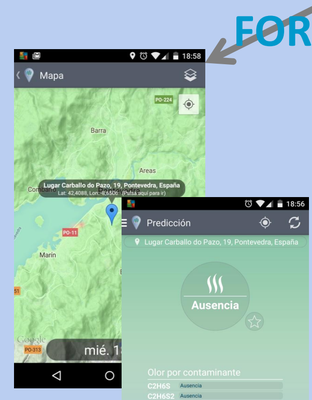
ABSTRACT

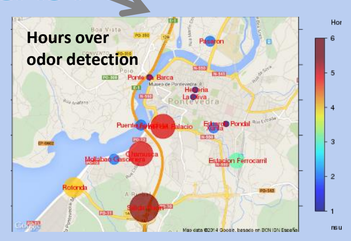
Odor episodes control due to low threshold perception odorants, as H_2S, is extremely difficult, as they are detected in very low concentrations. Traditionally, pulp paper mills using Kraft process produce TRS (Total Reduced Sulphur) odorants emissions, so their environment can be affected by odors. A model-based operational odor forecast system, namely PrOlor, was developed, tested and applied around ENCE pulp paper mill at Pontevedra estuary in order to prevent any short odor event (less than 1 hour). This system includes WRF model coupled to CALMET model, to provide meteorological inputs to CALPUFF model. Both surface wind and temperature WRF and CALMET models outputs were validated against surface measurements, and statistics calculated by Openair software usually accomplished valid ranges. About CALPUFF performance, estimated odorant ground level concentrations were converted to short odor event intensity applying both peak-to-mean approach and Steven's Law. When forecast short odor events were compared to the 34 short odor events registered, 32 of them were caught by PrOlor.

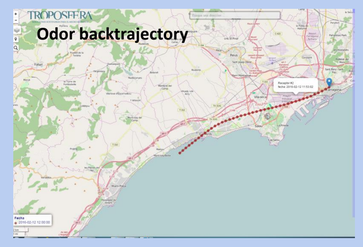
PrOlor











Calpuff2NetCDF

WRF-ARW
Max. Horiz. Res.: 1.3 km

CalWRF

CALMET (v. 6.334)
Horiz. Res. 250 m

CALPUFF (v. 6.42)
Output Grid Horiz. Res.: 250 m

Data Analysis / Application

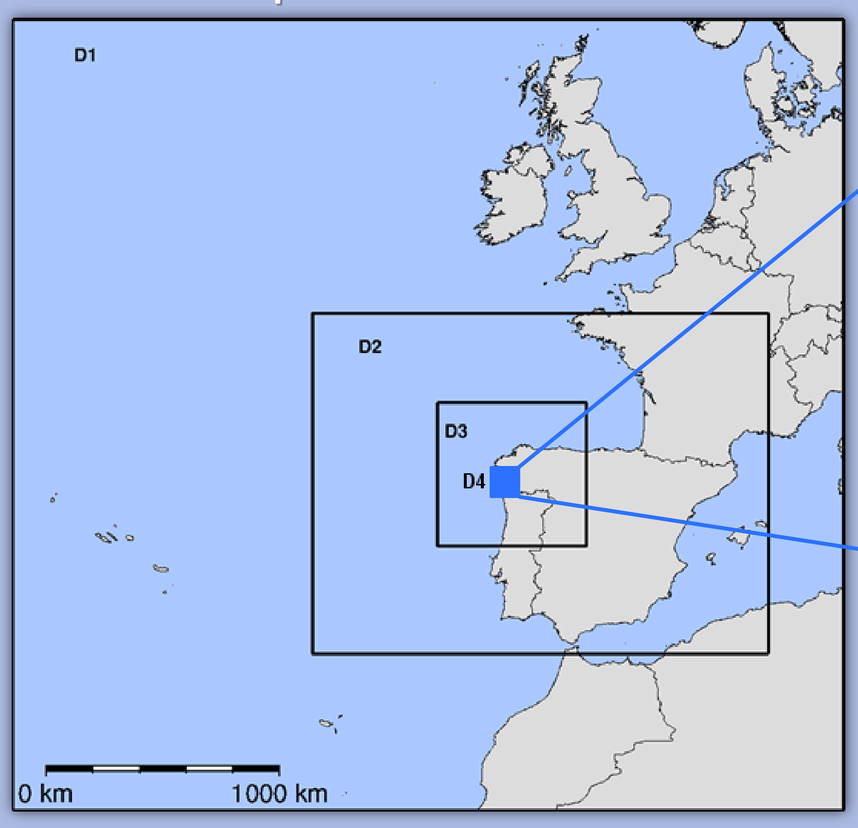
FORECAST

DEM
Spanish Geogr. Survey, CNIG

Land Use
True Marble GLCD

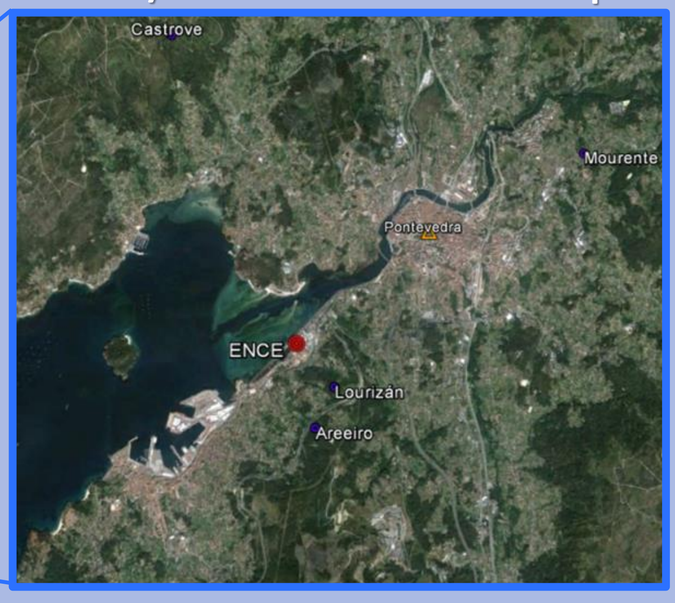
TRS EMISSIONS
Chromatech MEDOR TRS C51000

WRF-ARW setup

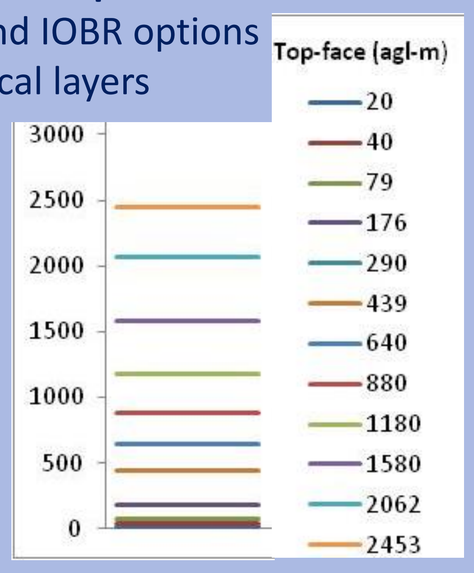


Radiation: LW RRTM, SW MM5-Dudhia
PBL: YSU Surface: 5 layer MM5 LSM
Cumulus: Kain-Fritsch Microphysics: WSM6

CALMET/CALPUFF domain & setup



CALMET setup
IKINE and IOBR options
12 vertical layers



CALPUFF setup
Hourly TRS diffusion with chemical decay and deposition

Dry (Gas) | Dry (Particle) | Wet

Species	Diffusivity (cm**2/s)	Alpha Star	Reactivity	Meso. Resist. (s/cm)	Henry's Law Coeff.
H2S	0.1509	1.0	18.0	0.0	8.70E-02
C2H6S2	0.1509	1.0	18.0	0.0	9.60E-01
C2H6S	0.1509	1.0	18.0	0.0	4.80E-01
CH4S	0.1509	1.0	18.0	0.0	2.00E-01
SO2	0.1509	1000.0	8.0	0.0	4.00E-02

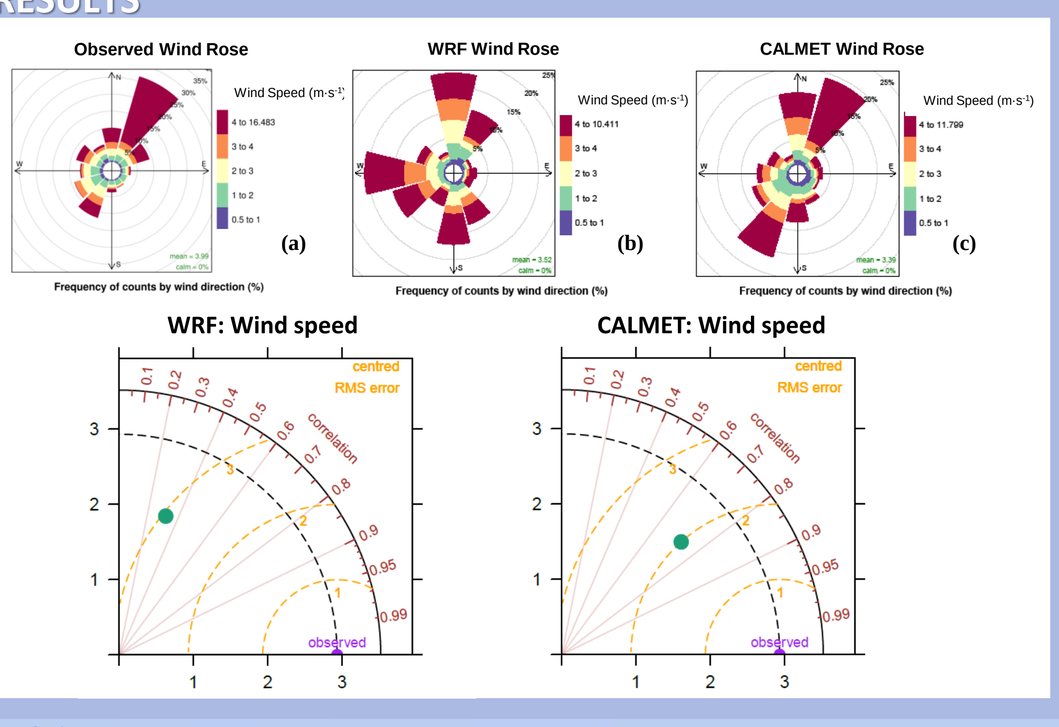
ODOR ESTIMATION
Odor level (Steven's Law)

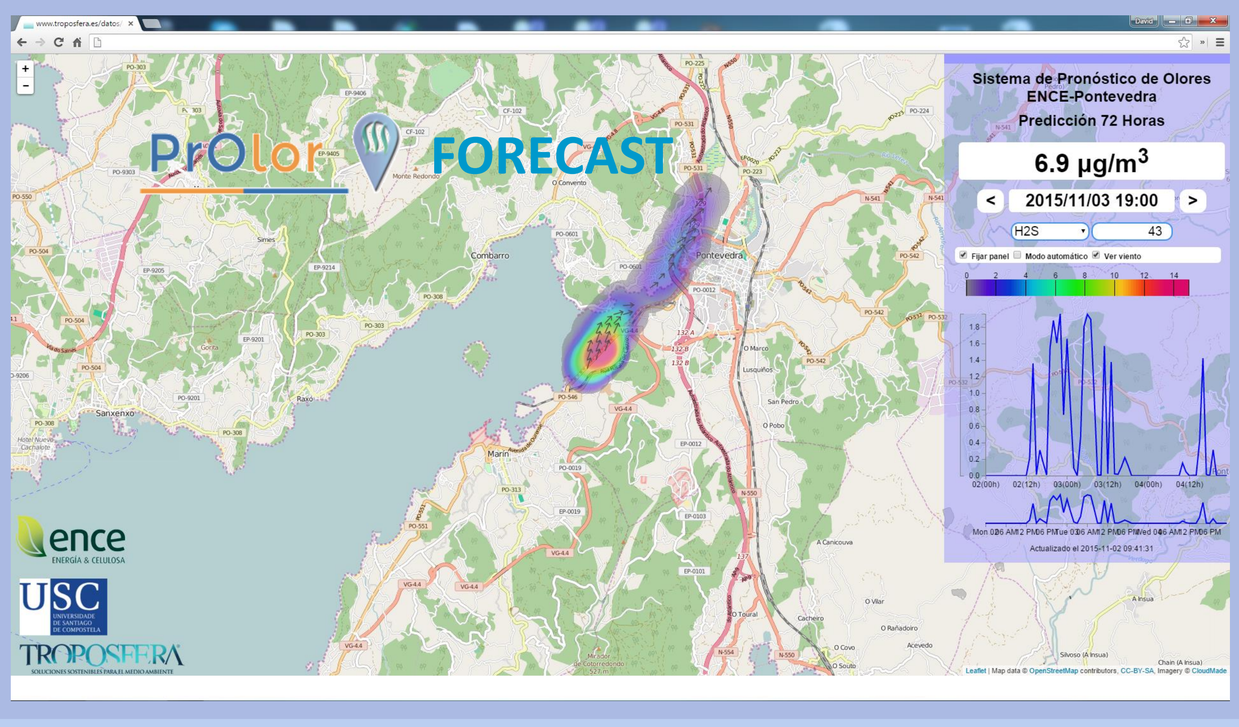
$$C[\mathrm{OU/m^3}] = 2000 \bullet C(\mathrm{H_2S})\ [\mathrm{ppm}]$$

Peak-to-mean (short events)

$$\frac{C_p}{C_m} = \left(\frac{T_m}{T_p}\right)^U$$

RESULTS





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